

What is claimed is:

1. A speech decoder for decoding a coded speech signal into a reproduction speech signal and for reproducing a speech signal by the use of the reproduction speech signal, including:

a spectral parameter calculating circuit, responsive to the reproduction speech signal, for calculating spectral parameters based on the reproduction speech signal;

an excitation signal calculating circuit for calculating an excitation signal and for obtaining a level of the excitation signal, on the basis of the reproduction speech signal and the spectral parameters calculated by the spectral parameter calculating circuit;

a smoothing circuit responsive to the spectral parameters and the excitation signal, for smoothing in time at least one of the spectral parameters and the level of the excitation signal, so as to output the spectral parameters and the excitation signal where at least one is subjected to smoothing; and

a synthesis filter circuit having a synthesis filter constructed with the spectrum parameters output from the smoothing circuit, and for synthesizing the excitation signal by using the synthesis filter, so as to reproduce the speech signal; wherein

the excitation signal calculating circuit, the smoothing circuit and the synthesis filter circuit operate in compliance with only predetermined conditions.

2. A speech decoder as claimed in claim 1, wherein the excitation signal calculation circuits carries out an inverse-filtering for the reproduction speech signal by the use of the spectral parameters, so as to calculate the excitation signal.

3. A speech decoder as claimed in claim 1, further comprising a mode-judging circuit for judging a mode of the reproduction speech signal by extracting feature quantities from the reproduction speech signal, wherein the predetermined conditions comprises a mode condition that the mode of the reproduction speech signal is judged as a predetermined mode by the mode-judging circuit, the excitation signal calculating circuit, so that the smoothing circuit and the synthesis filter circuit operate in only the case where the mode condition is met.

4. A speech decoder as claimed in claim 3, wherein the predetermined mode is silence.

5. A speech decoder as claimed in claim 3, wherein the predetermined mode is "unvoiced sound."

6. A speech decoder for decoding a coded speech signal into a reproduction speech signal and for reproducing a speech signal by the use of the reproduction speech signal, including:

a spectral parameter calculating circuit, responsive to the reproduction speech signal, for calculating spectral parameters based on the reproduction speech signal;

an excitation signal calculating circuit for calculating an excitation signal and for obtaining a level of the excitation signal, on the basis of the reproduction speech signal and the spectral parameters calculated by the spectral parameter calculating circuit;

a pitch-prediction circuit which calculates a pitch period from either the reproduction speech signal or the excitation signal, carries out a pitch prediction by the use of pitch period to produce a pitch prediction signal, and calculates a residual signal by subtracting the pitch prediction signal from the excitation signal;

a gain-calculating circuit for calculating a gain of at least one of the pitch prediction signal and the residual signal both output from the pitch-

prediction circuit;

a smoothing circuit responsive to the spectral parameters and the gain, for smoothing in time at least one of the spectral parameters and the gain, so as to output the spectral parameters and the excitation signal where at least one is subjected to smoothing; and

a synthesis filter circuit having a synthesis filter constructed with the spectrum parameters output from the smoothing circuit, and for newly producing an excitation signal as a proper excitation signal on the basis of the gain, the pitch prediction signal and the residual signal, and thereby for synthesizing the proper excitation signal by using the synthesis filter, so as to reproduce the speech signal.

7. A speech decoder as claimed in claim 6, wherein the excitation signal calculation circuits carries out an inverse-filtering for the reproduction speech signal by the use of the spectral parameters, so as to calculate the excitation signal.

8. A method of reproducing a speech signal, comprising:

first step of decoding a coded speech signal output from a speech coder, so as to produce a reproduction speech signal;

second step of calculating spectral parameters based on the reproduction speech signal;

third step of calculating an excitation signal and obtaining a level of the excitation signal, on the basis of the reproduction speech signal and the spectral parameters;

fourth step of smoothing in time at least one of the spectral parameters and the level of the excitation signal, so as to output the spectral parameters and the excitation signal where at least one is subjected to the smoothing; and

fifth step of synthesizing the excitation signal by using the synthesis filter constructed with the spectrum parameters, so as to reproduce the

speech signal; wherein

the second to fifth steps are carried out in only a case where predetermined conditions are met, while the reproduction speech signal is handled as the speech signal in another case where predetermined conditions are not met.

9. A reproducing method as claimed in claim 8, wherein the third step is carried out so that the reproduction speech signal is subjected to an inverse-filtering using the spectral parameters, to thereby calculate the excitation signal.

10. A reproducing method as claimed in claim 8, further comprising sixth step of judging a mode of the reproduction speech signal by extracting feature quantities from the reproduction speech signal, wherein the predetermined conditions comprises a mode condition that the mode of the reproduction speech signal is judged as a predetermined mode.

11. A reproducing method as claimed in claim 10, wherein the predetermined mode is silence.

12. A reproducing method as claimed in claim 10, wherein the predetermined mode is "unvoiced sound."

13. A method of reproducing a speech signal, comprising:
first step of decoding a coded speech signal output from a speech coder, so as to a reproduction speech signal;

second step of calculating spectral parameters based on the reproduction speech signal;

third step of calculating an excitation signal and obtaining a level of the excitation signal, on the basis of the reproduction speech signal and the spectral parameters;

fourth step of calculating a pitch period from either the reproduction speech signal or the excitation signal, carrying out a pitch prediction by the use of pitch period to produce a pitch prediction signal, and subtracting the

pitch prediction signal from the excitation signal to calculate a residual signal;

fifth step of calculating a gain of at least one of the pitch prediction signal and the residual signal;

sixth step of smoothing in time at least one of the spectral parameters and the gain, so as to output the spectral parameters and the excitation signal where at least one is subjected to the smoothing; and

seventh step of newly producing an excitation signal as a proper excitation signal on the basis of the gain, the pitch prediction signal and the residual signal, and then, synthesizing the proper excitation signal by the use of the synthesis filter constructed with the spectrum parameters, so that the speech signal is reproduced.

14. A reproducing method as claimed in claim 13, wherein the third step is carried out so that the reproduction speech signal is subjected to an inverse-filtering using the spectral parameters, to thereby calculate the excitation signal.